ABSTRACT

A catheter for emitting radiation is disclosed, comprising a catheter shaft and an x-ray unit attached to the distal end of the catheter shaft. The x-ray unit comprises an anode and a cathode coupled to an insulator to define a vacuum chamber. The cathode is preferably a field emission cathode of graphite or graphite coated with titanium carbide, for example. The anode is preferably tungsten and the insulator is preferably pyrolytic boron nitride. The x-ray unit is preferably coupled to a voltage source through a coaxial cable. The anode is preferably a heavy metal such as tungsten. The cathode may also be a ferroelectric material. The x-ray unit can have a diameter less than about 4 mm and a length less than about 15 mm. Methods of use of the catheter are also disclosed. The catheter of the present invention can be used to irradiate the site of an angioplasty procedure to prevent restenosis. It can also be used to treat other conditions in any vessel, lumen or cavity of the body.